Comprehensive Wastewater Treatment Facilities Plan

Task 3: Factors Other Than Cost-Effectiveness that Influence Selection of Treatment Technology

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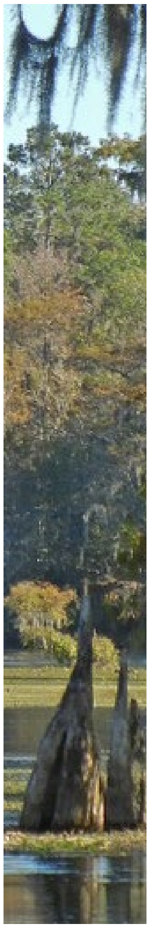

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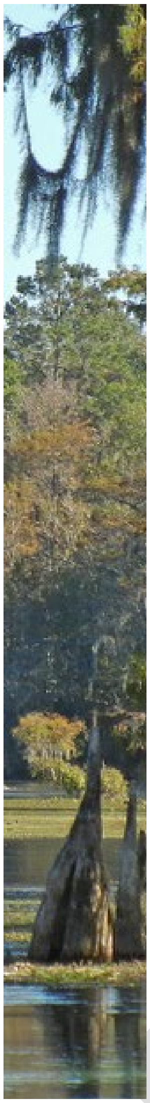

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ACRONYMS AND ABBREVIATIONS

ATM	Applied Technology & Management
ATU	Aerobic Treatment Unit
AWTS	Alternative Wastewater Treatment Systems
BMAP	Basin Management Action Plan
CWTFP	Comprehensive Wastewater Treatment Facilities Plan
DEP	Department of Environmental Protection
INRB	In-Ground Nitrogen-Reducing Biofilter
JSA	Jim Stidham & Associates
LAVA	Leon County Aquifer Vulnerability Assessment
OFW	Outstanding Florida Water
OSTDS	Onsite Sewage Treatment and Disposal System
PBTS	Performance Based Treatment System
PFA	Priority Focus Area
PSPZ	Primary Springs Protection Zone
TMDL	Total Maximum Daily Load
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

Leon County is developing a plan to reduce nitrogen loads from existing onsite sewage treatment and disposal systems (OSTDSs), as well as future development, to groundwater and surface waters. OSTDSs are also known as septic systems. The Florida Department of Environmental Protection found that nutrient loads from several sources—including OSTDSs in Leon County—impaired Upper Wakulla River and Wakulla Spring. Leon County's plan has two parts: (1) a comprehensive wastewater treatment facilities plan for the entire county, and (2) a more focused facilities plan for part of the county that loads nitrogen to the Wakulla River and Wakulla Spring. Objectives of the plan are to: (1) identify OSTDSs to transition to alternative wastewater treatment systems (AWTSs) where the transition will most reduce nitrogen loads to surface waters and groundwater; and (2) identify future development that requires AWTSs to reduce nitrogen loads to surface waters and groundwater.

Leon County is developing the plan by progressing through eight major tasks. This report describes the results of the third task: evaluation of factors other than cost-effectiveness that influence selection of treatment technology. This task includes an evaluation of 15 factors that influence the selection of AWTSs. AWTSs are one mitigation approach to reduce nutrient loads to surface waters and groundwater. The task 3 evaluation was conducted on a countywide basis and will be applied to each area of the county in task 5.

This task 3 report describes the following preliminary findings:

Finding 1. On a countywide basis, in-ground nitrogen-reducing biofilters (INRBs) scored the highest, followed by performance-based treatment systems (PBTSs) and aerobic treatment units (ATUs) using the evaluation factors for mitigation criteria in task 3.

Finding 2. On a countywide basis, cluster systems scored the lowest using the evaluation factors for mitigation criteria in task 3. However, cluster systems may be the best option for specific areas of the county, which will be evaluated further in upcoming tasks.

Finding 3. The applicability of each of the evaluation factors is specific to the conditions in each part of the county.

Task 3 findings are preliminary and subject to refinement as development of Leon County's plan progresses.

1.0 Introduction

The Florida Department of Environmental Protection (DEP, 2018) found that nutrient loads from several sources impaired Upper Wakulla River and Wakulla Spring. To develop a plan to restore the river and spring, DEP calculated the maximum amount of nitrate that the river and spring can receive each day, while still satisfying water quality standards. This maximum amount is called a total maximum daily load (TMDL). DEP prepared the Upper Wakulla River and Wakulla Spring Basin Management Action Plan (BMAP) to restore the river and spring by identifying actions that will reduce pollutant loads to the river and spring. The BMAP was adopted by DEP in June 2018 and requires that stakeholders, including Leon County, reduce nitrogen loads to the river and spring from onsite sewage treatment and disposal systems (OSTDSs). OSTDSs are also known as septic systems. Leon County contracted Jim Stidham & Associates (JSA) to develop the plan to reduce nitrogen loads from OSTDSs. JSA partnered with Advanced Geospatial, Applied Technology & Management (ATM), The Balmoral Group, Magnolia Engineering, and Tetra Tech to develop the plan. JSA and these partners are referenced throughout this plan as the JSA team.

The Leon County plan has two parts: (1) a comprehensive wastewater treatment facilities plan (CWTFP), and (2) a more focused facilities plan for the part of the county governed by the BMAP. The CWTFP is funded through a grant from the Blueprint Intergovernmental Agency. DEP funded the BMAP plan with a grant to the county. About 40% of Leon County is served by OSTDSs, about 20% is served by five centralized wastewater treatment facilities (WWTFs), and about 40% is government land that will not likely be developed during the next few decades and will not likely require wastewater treatment (fig. 1).

The objective of Leon County's plan is to identify existing OSTDSs to transition to alternative wastewater treatment systems (AWTS), where the transition will most reduce nitrogen loads to the river and spring. The plan will produce guidance for retrofit of existing development as well as direct technology selection for future development. The JSA team is creating the Leon County plan by performing the following tasks:

- Task 1. Develop a nitrogen reduction score to identify likely contribution of nitrogen from OSTDSs to groundwater and surface waters; use the score to quantify, rank, and identify OSTDSs to transition to AWTS; and establish nitrogen reduction criteria for AWTSs for each of the separate delineated areas (Completed)
- Task 2. Quantify cost-effectiveness of AWTS (Draft Completed)
- Task 3. Identify other factors that influence selection of an AWTS
- Task 4. Provide education to the community regarding information compiled in tasks 1, 2, and 3 and survey opinions of the citizens of Leon County, with respect to this plan
- Task 5. Analyze implementation scenarios for AWTS
- Task 6. Calculate the anticipated decrease in nitrogen load to the Upper Wakulla River and Wakulla Spring, between 2020 and 2040, due to OSTDS transition to AWTS
- Task 7. Provide additional education to the community regarding the information compiled in tasks 1 through 6 and conduct additional survey of opinions of the citizens of Leon County, with respect to this plan
- Task 8. Present the plan to the Leon County Board of County Commissioners

This report describes task 3 of the Leon County plan: factors other than cost-effectiveness that influence selection of treatment technology.

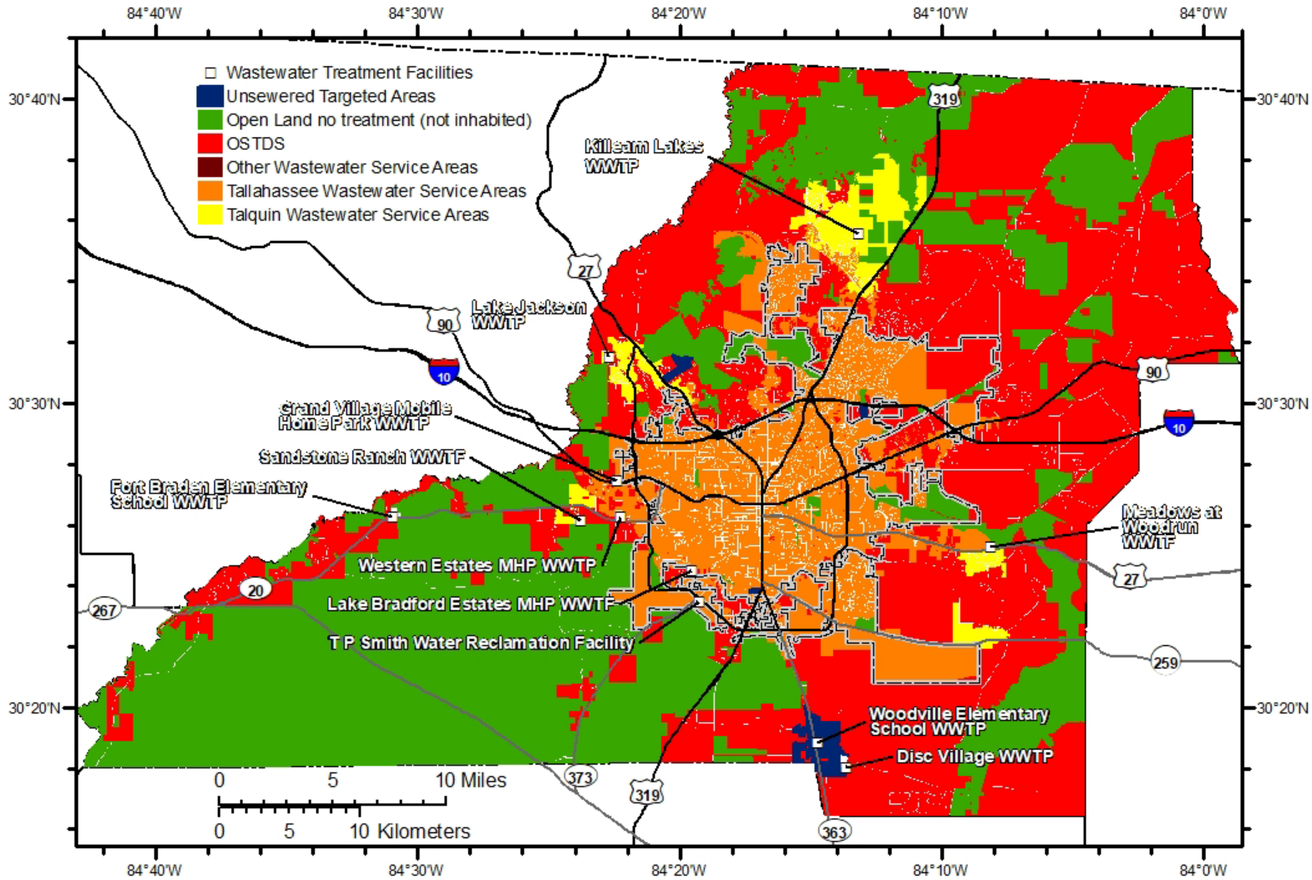

Figure 1. Parcels with an OSTDS, five centralized WWTFs, parcels in the Tallahassee wastewater service area, and parcels in the Talquin service area.

The objective of task 3 was to evaluate factors other than cost that influence the selection of the following alternative treatment technologies:

- Aerobic treatment unit (ATU) – In these systems, effluent passes through an aeration stage prior to discharge to the drainfield. This system is mechanical, with a blower to aerate the effluent, and sometimes includes recirculation.
- Performance-based treatment system (PBTS) – In these systems, effluent passes through two stages of treatment: (1) nitrification tank, and (2) one or more stages of denitrifying media. This system can also include recirculation.
- In-ground nitrogen-reducing biofilter (INRB) – These systems include a reactive media layer consisting of wood mulch, sawdust, or other organic material mixed with sand under a conventional drainfield so that effluent in the drainfield percolates through the media.
- Cluster systems – These are wastewater treatment systems designed to serve two or more dwellings or facilities with multiple owners. These systems require land to install and an entity that is responsible for managing the system. Cluster systems may use ATU, PBTS, or INRB.
- Central sewer systems – These are wastewater collection systems that connect to multiple residences and use a combination of gravity and pressure piping systems to transport wastewater to a central treatment plant.

The JSA team evaluated cost factors associated with these AWTSs in task 2.

In this report, the JSA team summarizes data used to evaluate other factors (section 2), presents the draft results of the treatment selection evaluation (section 3), and presents the preliminary findings of the evaluation (section 4).

2.0 Evaluation Factors

The JSA team evaluated 15 factors that influence the selection of AWTSs:

1. Site proximity to priority focus areas (PFAs) and the Primary Springs Protection Zone (PSPZ) (section 2.1)
2. Site proximity to the urban service area and rural communities (section 2.2)
3. Availability of land for cluster treatment systems (section 2.3)
4. Easement or right-of-way acquisition for wastewater collection systems (section 2.4)
5. 2020 population density and population density in the future (section 2.5)
6. Social and economic impacts to land use (section 2.6)
7. Technology performance history (section 2.7)
8. Scalability (section 2.8)
9. Suitability of an AWTS to previously constructed homes (retrofit) versus the suitability of an AWTS to the construction of new homes (section 2.9)
10. Capacity of existing WWTFs (section 2.10)
11. Proximity to a centralized wastewater collection system (section 2.11)
12. Property owner participation (section 2.12)
13. Implementation time (section 2.13)
14. Wastewater treatment components of the Leon County Comprehensive Plan (section 2.14)
15. State of Florida rules for OSTDS permits (section 2.15)

2.1 Site Location in Priority Focus Areas and the Primary Springs Protection Zone

DEP delineated two PFAs in the Upper Wakulla River and Wakulla Spring BMAP (fig. 2). PFAs define vulnerable parts of the Upper Floridan aquifer that contribute constituents to the spring. PFAs are in a part of the springshed in which the Upper Floridan aquifer is unconfined. In 2007, Leon County defined the PSPZ in the Leon County Land Development Code (fig 2.). The county protects the PSPZ in the code with measures that reduce nutrient loads to the spring. The location of a parcel in a PFA or the PSPZ is one of the most important factors in targeting the parcel for conversion to an AWTS or connection to centralized wastewater collection systems. Based on scientific review, land surface activities in the PFA and PSPZ of Leon County have the greatest impact on water quality in Wakulla Spring.

DEP prepared the Upper Wakulla River and Wakulla Spring BMAP to comply with the requirements of the Florida Springs and Aquifer Protection Act, which is intended to protect and restore Outstanding Florida Waters (OFW), including Wakulla Spring. Wakulla Spring was determined to be an impaired first magnitude OFW, and a TMDL was established for nitrate to further restoration of water quality in the spring. OSTDSs were determined to be one of the main sources of nitrogen contributing to the decline of water quality in Wakulla Spring. The BMAP states that nitrogen reduction efforts in PFAs will provide the most benefit toward restoration of water quality. A part of southern Leon County is in PFA1, which is the PFA with the greatest probability of regularly contributing nitrogen loads to Wakulla Spring.

The Florida Springs and Aquifer Protection Act was passed in the 2016 legislative session. The act prohibits conventional OSTDS on parcels less than one acre within the PFA, unless the OSTDS includes enhanced treatment for nitrogen or a connection to the centralized wastewater collection system will be available within five years. When an existing traditional OSTDS must be repaired or replaced, the OSTDS must include nitrogen-reducing enhancements, unless connection to the centralized wastewater collection system will be available within five years.

Leon County began studying the impacts of nitrogen to Wakulla Spring and other waterbodies in the early 2000s. Baker et al. (2007) completed the Leon County Aquifer Vulnerability Assessment (LAVA), a tool which identified areas of Leon County where the Floridan aquifer is most vulnerable to adverse impacts from activities on the land surface. This led to the development of specific measures to protect these vulnerable areas. For example, Policy 4.2.5 of the Conservation Element of the Tallahassee-Leon County Comprehensive Plan required the mapping of the PSPZ by 2010, based on the results of the LAVA study. The Comprehensive Plan further requires the City of Tallahassee and Leon County to adopt regulations to minimize adverse impacts to groundwater in the PSPZ. It requires connection to sewer with advanced WWTFs where feasible, and PBTSs where connection is not feasible.

In March 2009, the Leon County Board of Commissioners adopted the PSPZ (Section 10-6.710 of the Leon County Land Development Code). The PSPZ generally overlaps the PFA in Leon County and includes lands west and east of the PFA. The PSPZ boundary is coincident with roadways, section lines, and quarter-section lines.

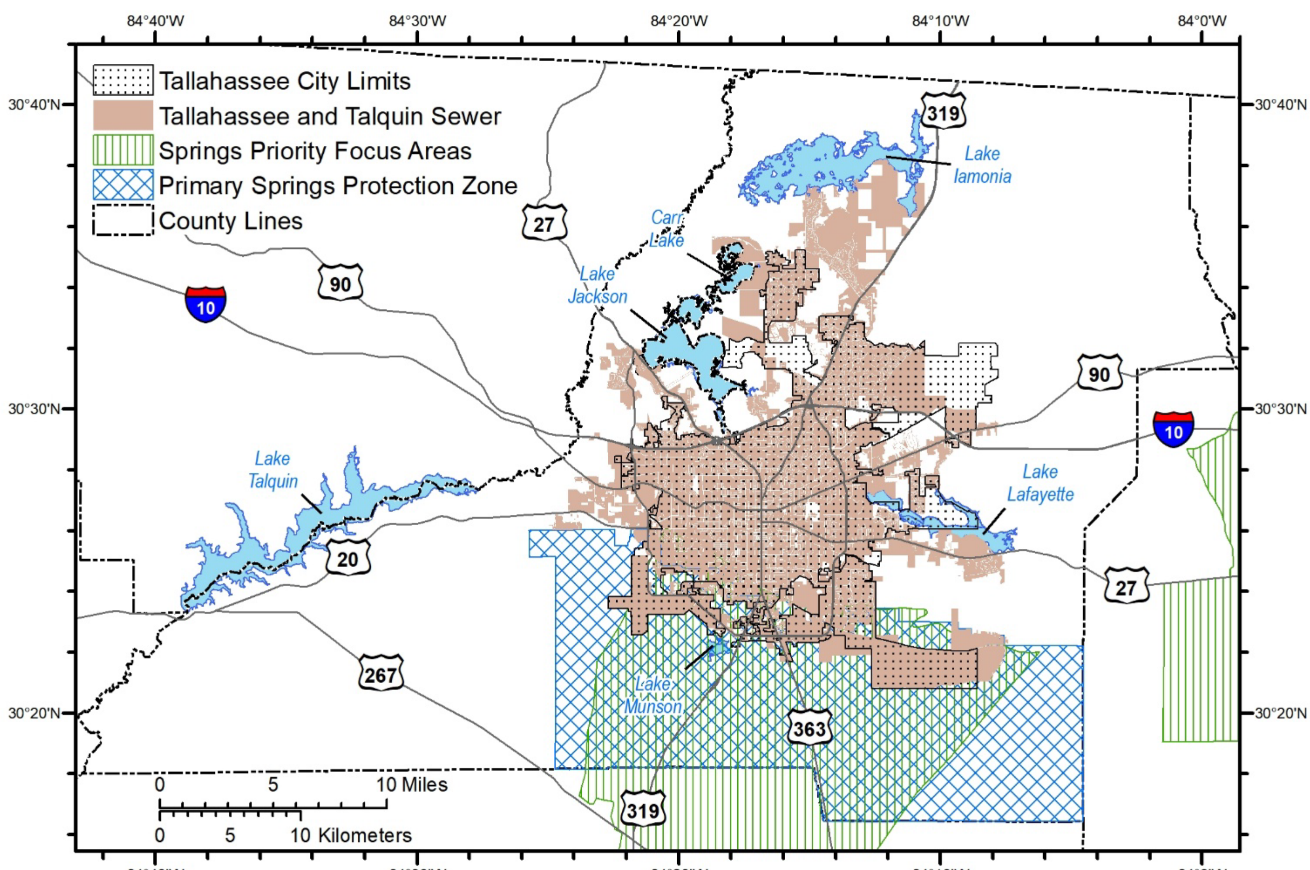

Figure 2. Priority focus areas, Primary Springs Protection Zone, and wastewater service areas.

2.2 Site Location Relative to the Urban Service Area and Rural Communities

A parcel's location relative to the urban service area will determine whether connection to a centralized wastewater collection system is feasible in 2020 and/or in the future. The purpose of the urban service area, as defined in the Comprehensive Plan, is to direct development toward the capital infrastructure needed to serve it, including sanitary sewer (central wastewater). The limits of the urban service area are determined based on the area necessary to accommodate 90% of new residential units anticipated during the planning period, the ability to provide capital infrastructure in this area, and the presence of environmentally sensitive lands and waterbodies requiring protection from the impacts of urban development. The plan prohibits capital improvement projects outside the urban service area, unless a demonstrated hardship is present, and such hardship may include failing septic systems, where the potential for severe environmental degradation is present. In the case of hardship, the capacity of new infrastructure to address the hardship is limited to development existing prior to February 1, 1990. The Comprehensive Plan allows for centralized potable water distribution and centralized wastewater collection in designated enclaves such as the Woodville Rural Community. In other rural communities, where development densities do not support capital infrastructure and centralized wastewater collection system is not planned, alternative methods of nitrogen reduction from OSTDSs must be considered. Additional details about the Comprehensive Plan limitations for wastewater, cluster systems, and OSTDS within the urban service area and rural communities are included in Section 2.14.

2.3 Adjacent Land Availability for Cluster Treatment Systems

Cluster treatment systems are used to treat wastewater from multiple homes. Therefore, these systems are not limited to one parcel and land will need to be acquired to install the cluster system. Cluster systems work best in residential areas with relatively greater density, where density reduces the amount of pipe needed to convey wastewater from each residence to the cluster system. For the purposes of this study, an upper limit of 16 residential units per cluster system is used.

For a cluster system to be most cost-effective, it should be placed near the parcels it will be treating. For this study, vacant parcels near multiple residential units on OSTDSs or near vacant parcels that will be developed in the future on OSTDSs were evaluated (fig. 3). Parcels colored green or yellow are closer to less developed parcels and more appropriate for cluster installation than parcels colored orange or red.

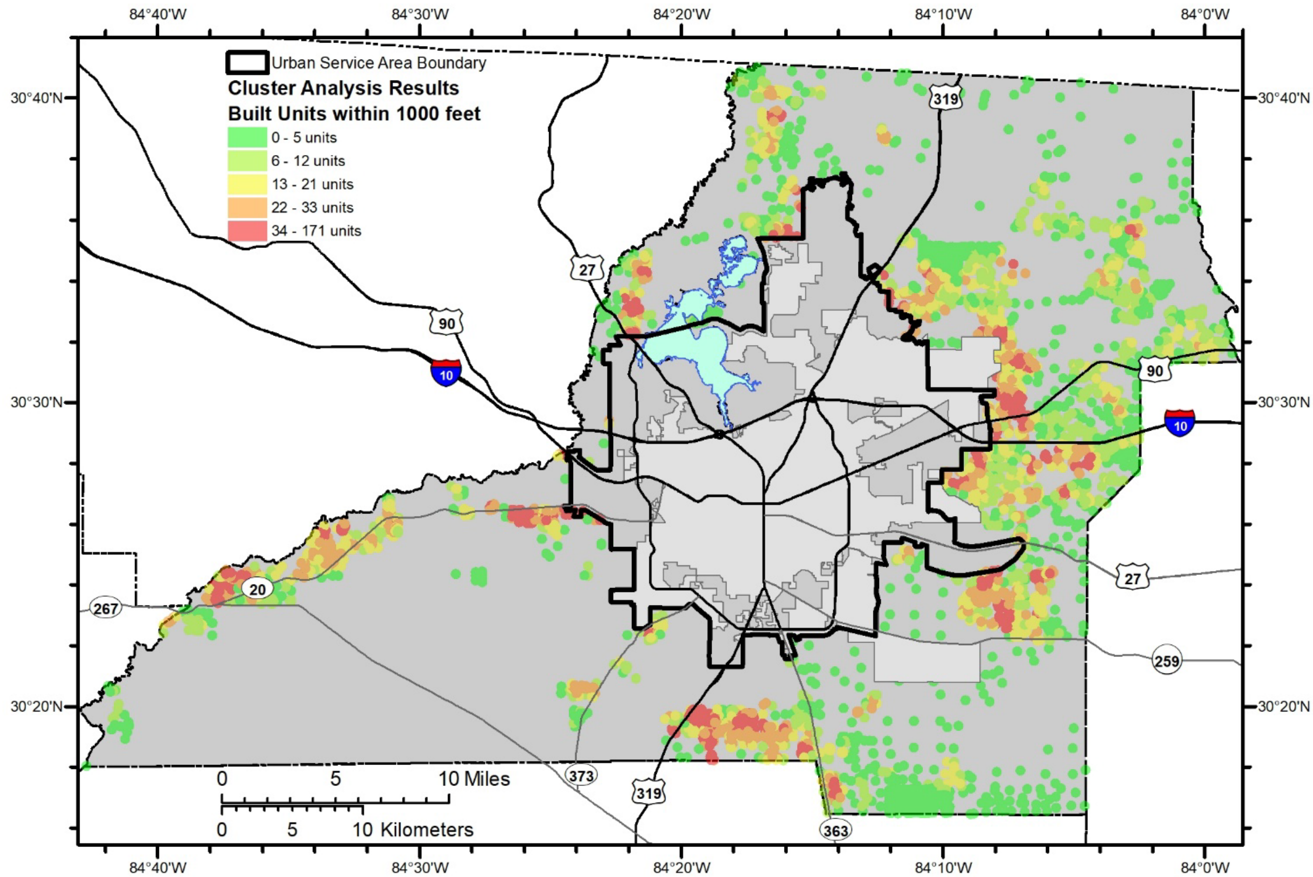

Figure 3. Vacant parcels within 1,000 feet of parcels with existing septic systems.

2.4 Easement Acquisition for Collection System Construction

Easements or rights-of-way may be necessary for cluster and centralized wastewater collection systems. Easements are not required for individual ATUs, PTBSs, or INRBs because these systems will be installed on individual properties.

For cluster systems, easement size may depend on the number and configuration of parcels served. Easements may be necessary to access collection system infrastructure from each parcel and for maintenance. An easement may also be necessary to provide the required 75-foot buffer (per Chapter 64E-6, Florida Administrative Code, Table V) between the treatment system drainfield and surrounding private water wells. Existing utility easements are typically used for centralized wastewater collection systems. However, if an easement does not exist, an easement must be acquired. In older developments where roadways are privately held and maintained, the acquisition of the utility easement can be difficult, time consuming, and costly. Sewer laterals to individual parcels will be located on the parcel and should not require easement acquisition.

2.5 Density of Existing Development and Future Land Use

Existing high density areas or future land use categories that allow for higher density developments provide a potential for nitrogen hotspots in the County. If these areas are located near existing wastewater infrastructure (e.g., lift stations), then the nitrogen impacts from development can be mitigated with additional nitrogen treatment provided by the existing WWTF. Many of the higher density areas are currently located near or in the urban service area. The configuration of higher development densities limits use of certain types of OSTDSs and may make centralized wastewater collection systems a more cost-effective approach for nitrogen reduction and sewage treatment.

As development continues, the existing wastewater infrastructure must be extended to serve the outward expansion of these higher density developments. Higher development densities should be limited to areas near the existing urban service area to allow for the most cost-effective expansion of the wastewater collection system. Where higher development densities are approved for construction in the outlying areas of the County, other treatment technologies will need to be used. In these areas, cluster systems may be a good option and can be planned to provide wastewater collection infrastructure for future conversion to sewer as the urban service area increases. Within task 5, these criteria will be evaluated in further detail in the location-specific analysis. Table 1 summarizes these general density considerations.

Table 1. *Pros and cons of development density for treatment options.*

Area	Pros	Cons
High Density	- More cost-effective for sewer use - Nitrogen treatment is less costly per household	- Limits use of an OSTDS due to lack of land to allow for adequate setbacks
Low Density	- Allows for use of an OSTDS	- Difficult to use central collection system - Nitrogen treatment more costly per household

2.6 Anticipated Impacts to Existing and Future Land Use Density

Two factors interact and contribute to the selection of feasible and optimal AWTS: (1) household density (measured as persons per household), and (2) housing density (measured as dwelling units per acre). The household density governs the expected wastewater nutrient loading at the individual parcel level as the greater the persons per household, the greater the nutrient loading. This factor may be constrained by site-specific conditions such as drainfield area, depth to groundwater, or distance to karst features and thus the choice of individual OSTDS. The housing density relates to the need for (and financial viability) of cluster or centrally served systems. Areas with lower housing density will have higher capital costs per unit. The housing density by land use throughout the county is described in detail in the task 1 report. An understanding of Leon County's demographics, especially that of the PFA, will contribute to defining the feasibility and cost-effectiveness of AWTS options in each area meeting BMAP objectives.

Leon County is diverse in its demographic and socio-economic makeup. Different census blocks and block groups, including parameters such as persons per household, median income, and median age, among others, will be positioned differently in terms of funding the construction (i.e., system purchase) and longer-term operation of AWTS. As an example, figure 4 denotes that persons per household (and corresponding wastewater demand and potential income) vary from 1.61 to 3.84 in the south and southeastern part of the County. The range is more than double that of the minimum value.

While greater median income is no assurance that a household can readily pay for an AWTS retrofit, it may be a proxy for the probability that such systems will be installed or that they will be installed earlier during the CWTFP timeline, and that BMAP objectives will be timely met. This same factor weighs the long-term cost of system operation and maintenance that, for ATUs and PBTSs, is the crucial factor to achieve nitrogen reductions. Recognizing there is a learning curve with new systems, especially where homeowner operation and compliance with maintenance contracts and monitoring is an expectation, median education level (another demographic attribute) may also be a proxy for projecting nitrogen reduction success.

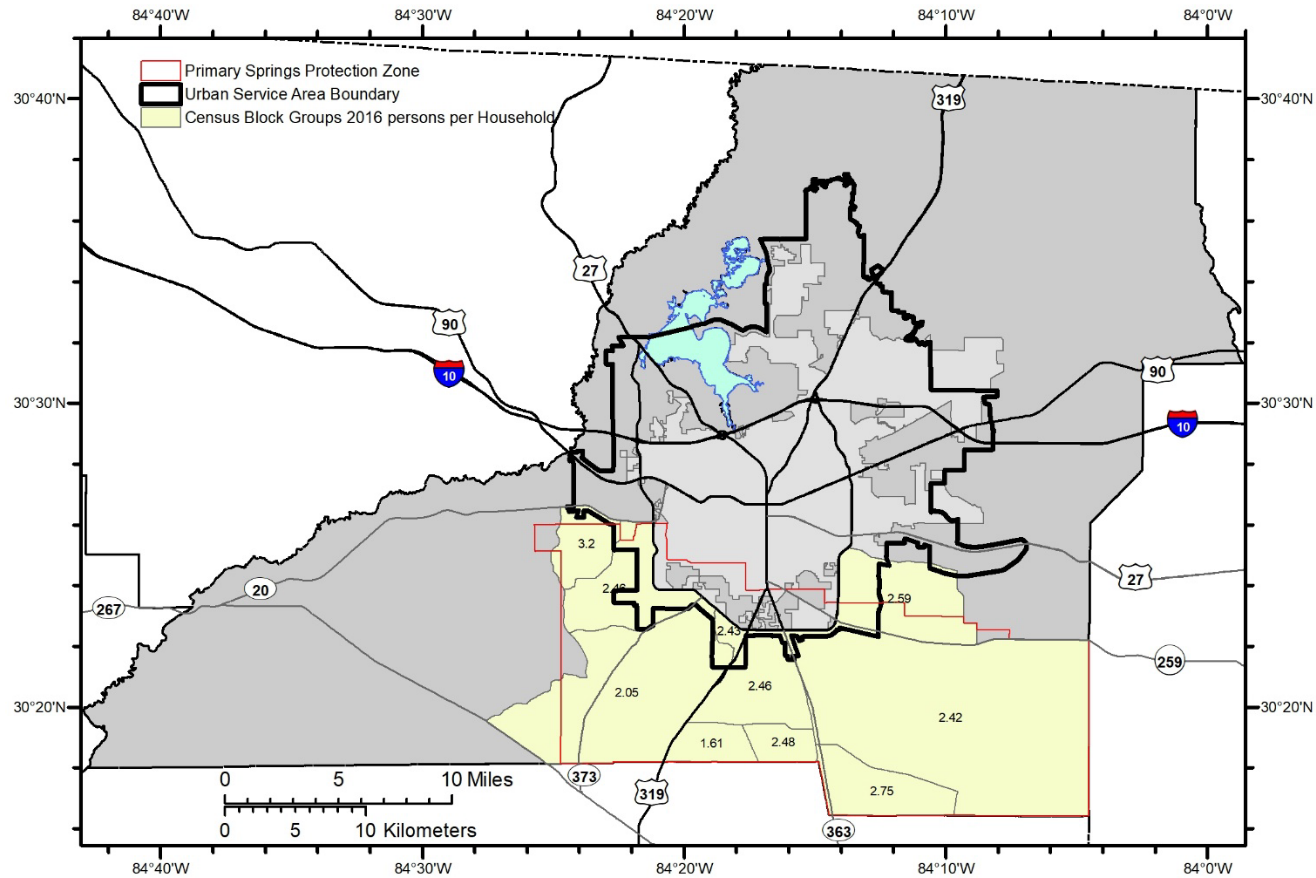

Figure 4. *Leon County persons per household by block group (U.S. Census Bureau, 2017).*

Median household income and education levels are above the county-wide average (and greatest in the PFA) in block groups 120730026041 and 120730026041, on either side of Tram Road, east and south of U.S. 319 (fig. 5). Outside of the city limits and wastewater services area, block group 120730046033 (at the county line east of U.S. 319) has a lesser than average median household income and relatively greater percentage of population without a high school diploma. Census block groups north of State Road 263/U.S. 319 that are between Springhill Road and Tram Road have below average household income and lower rates of high school graduation. These areas are likely to be served by centralized wastewater collection systems.

With respect to economic impact, there are 6,764 households in core census block groups in PFAs, external to the city wastewater services area. If all households upgrade to either an ATU or PBTS, total investment—at an average direct cost of $17,050 per household—will be greater than $115.3 million. Using Leon County-specific multipliers (IMPLAN economic impact assessment software) for water, sewerage, and other systems, that investment will generate 520 jobs, indirect economic impacts of about $43.8 million, induced impacts of $25.2 million, and a total economic impact of $184.4 million.

To help ensure a greater probability of nitrogen reduction and BMAP compliance, Leon County may look to amend Future Land Use Map categories (and the implementing zoning districts) in subareas of the PSPZ based on census data. Specifically, downzoning areas (reducing density) will reduce the need for wastewater treatment systems and connections and lower total system costs of meeting BMAP objectives. However, there will likely be the need for property owner compensation, which will have to be factored into total wastewater program costs. Reducing density will inflate land purchase costs and potentially engage homeowners with relatively more income or developers serving this income market and, based on the above argument, improve nitrogen performance whether among individual lots or as part of a cluster system. Conversely, upzoning (increasing densities) in areas that contribute less nitrogen to groundwater or are in proximity to existing WWTF service can reduce the costs of retrofit and connection because more properties can be served with fewer feet/miles of line, existing system capacity can be taken advantage of, and nitrogen reduction per property can be maximized.

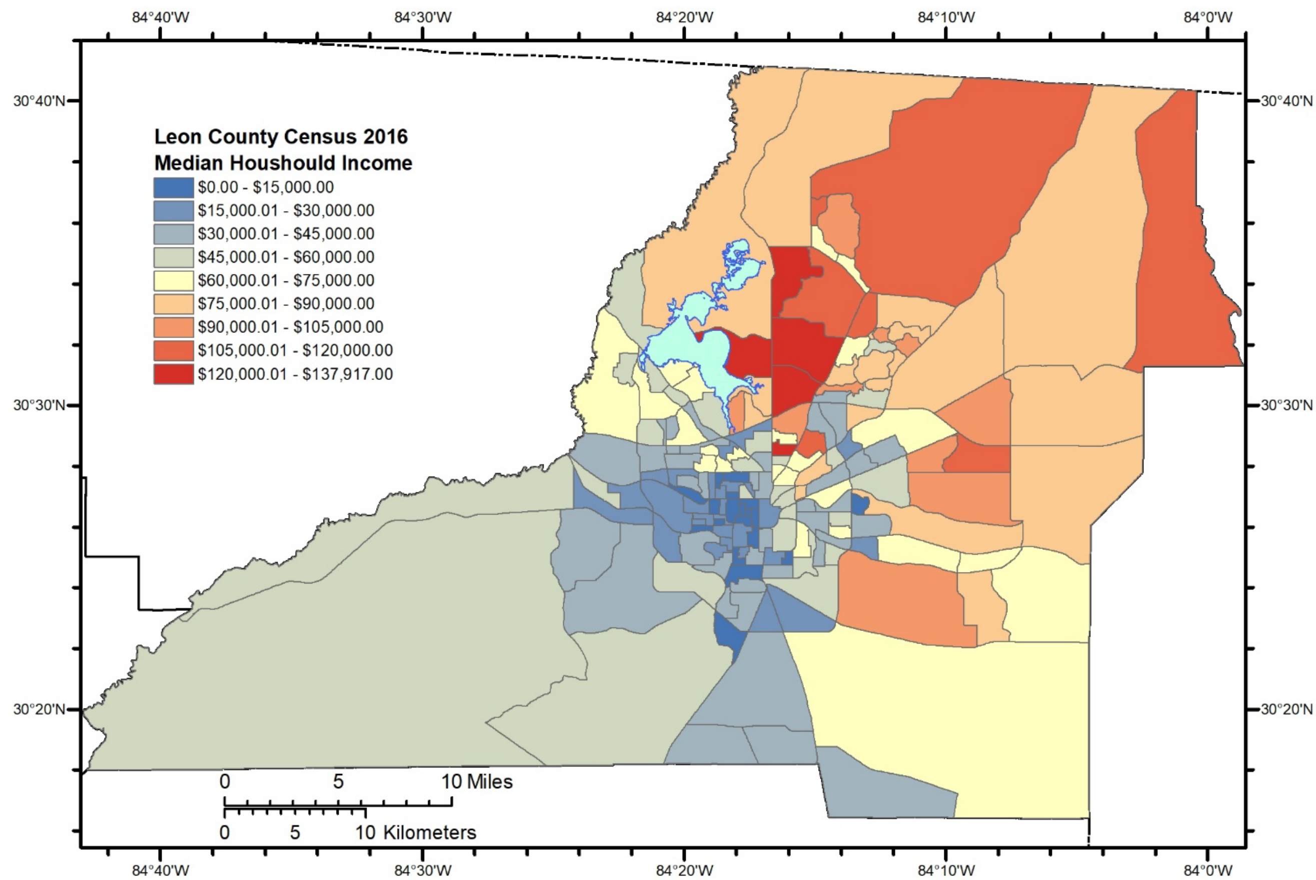

Figure 5. *Leon County median income by block group (U.S. Census Bureau, 2017).*

2.7 Technology Performance History of Reliability in Similar Site Conditions

The use of AWTSs in Florida is still fairly new, but these technologies are becoming more common, especially in areas around OFWs that must meet the requirements of the Florida Springs and Aquifer Protection Act.

ATUs and PBTSs have several approved models on the market and have been used in Florida for years. ATUs provide a nitrogen reduction in the range of 50%–79% in the tank, plus additional reductions in the drainfield. PBTSs provide a nitrogen reduction in the range of 52%–77% in the tank, plus additional reductions in the drainfield. However, both systems require power for the pump as well as operating permits. In applications of these systems in and around Leon County, many homeowners shut off the pumps to save energy and because of the noise. Without pumps, these systems function as conventional OSTDSs and additional nutrient reduction benefits are not achieved. The operational requirements of these systems need to be considered when identifying locations for implementation, and an education program may be needed in conjunction with the use of these systems.

INRBs are newer systems that are not as common in Florida. These systems can achieve nitrogen reductions of about 65%, which mostly occur in the drainfield. While the expected nitrogen reductions from INRBs are less than ATUs and PBTSs, these systems are passive, with no pumps or power requirements. Therefore, homeowners do not have to worry about operating the pumps, so the systems may more consistently achieve the nitrogen reductions than ATUs and PBTSs. However, the drainfield media will need to be replaced periodically, and INRBs require more space for installation and a greater separation from the water table than conventional drainfields, so potential sites for installation of these systems are more limited.

Table 2 provides a summary of the pros and cons for the ATU, PBTS, and INRB systems.

Cluster systems are not widely used in Florida. As these systems collect wastewater from multiple properties, they require a management entity, whether a utility or a Responsible Management Entity, to ensure proper maintenance and function. Cluster systems can use any of the above described nutrient removing technologies, depending on the design and construction of the collection tank and drainfield. When properly managed, these systems can achieve nutrient reductions up to 76% (including the drainfield) and avoid issues with individual homeowner operation.

Centralized wastewater collection systems are used throughout Florida, and a well-maintained collection system that conveys wastewater to a treatment facility results in a greater nutrient reduction than onsite systems. In areas with centralized wastewater collection systems infrastructure or where infrastructure can cost-effectively be extended, this option provides the greatest level of nutrient treatment. These systems can be difficult and costly to construct in level terrain, such as lower Leon County. The most cost-effective solution for these systems is gravity flow. However, in these level areas, pressure systems must be designed, which increases the construction cost substantially.

***Table 2.** Summary of pros and cons of ATUs, PBTSs, and INRBs (adapted from information from the Florida Department of Health, 2020).*

Treatment Technology	Pros	Cons
ATU	Effective nitrogen removal. Approved systems provide 50% to 79% nitrogen removal plus additional treatment in the drainfield.	Require operating permits from the county health department, which is the homeowner's responsibility.
	Existing permitting pathway through county health departments.	Requires annual inspection by the health department and biannual maintenance by a certified contractor at the homeowner's expense.
	Many approved systems on the market. Some have been constructed and operated in Florida for many years.	Does not operate when the power is off. Depending on the system construction, it could result in backed up drains when the power is off.
	Installation does not require a new drainfield.	Lifetime costs are greater than INRBs. Overall costs include permits, construction, design, equipment purchase, maintenance/repair, inspection, and energy consumption.
		Aesthetic issues with blower/pump noise and odor from vents.
PBTS	Some designs remove more nitrogen. Approved systems range from 52% to 77% nitrogen removal plus additional treatment in the drainfield.	Must be designed by an engineer and constructed under engineering oversight, which is an additional cost.
	Existing permitting pathway through county health departments.	Require operating permits from the county health department, which is the homeowner's responsibility. Permits vary depending on the system installed.
	Several approved systems are on the market. Some have been constructed and operated in Florida for years.	Required inspection by the health department and maintenance by a certified contractor at the homeowner's expense. The maintenance frequency varies depending on the system.
	Septic system contractors in most areas of the state know how to install and maintain these systems.	Does not operate when the power is off. Depending on the design, it could result in backed up drains when the power is off.
	Installation does not require a new drainfield.	Lifetime costs are greater than INRBs. Overall costs include permits, construction, design, equipment purchase, maintenance/repair, inspection, and energy consumption.
INRB	Testing has shown they reduce nitrogen by at least 65%.	Not suitable for some sites because of depth and/or footprint limitations. Typically requires an excavation greater than 5 feet and a water table deeper than about 7 feet and enough room for excavating equipment and soil stockpiling.
	Can be constructed as a truly passive system with no pump or energy requirement so it will still operate when there is no power.	New technology that has not come into common usage yet. Few septic tank contractors have experience or training in installation.
	Uses commonly available materials (e.g., recycled wood mulch and soil) and straightforward design. No equipment needs to be installed.	Testing has shown that INRBs reduce nitrogen by about 65%, which includes treatment in the drainfield plus reactive media. Overall nitrogen removal may be less than ATUs or PBTS plus their drainfields.
	Requires only a construction or repair permit from the county health department. There is no operating permit, engineering design, inspection, or maintenance requirements.	Installation requires replacement of the drainfield.
	Lesser lifetime costs than ATUs or PBTSs. Costs include only initial construction permit and installation.	

2.8 Scalability of Technology

Wastewater loads to cluster systems is greater than loads to an OSTDS that serves one household. For this reason, cluster systems must be evaluated more thoroughly than OSTDSs designed for a single household. Selection of the design flow is more important. Cluster systems will have a larger hydraulic load impacting a larger area of soil, and the possibility of overwhelming the soil's infiltrative capacity is greater. Designs should be based on actual per capita flows, rather than on the number of bedrooms, and a safety factor should be incorporated into the design. In retrofit areas, individual septic tanks can be left in place on the properties to help buffer the flows to the cluster system. In addition, proper operation and maintenance become more important with larger systems and larger flows. A management entity is necessary to ensure good long-term functioning of cluster systems.

A cluster system may be constructed using any of the AWTS technologies. Passive cluster systems would use INRB technologies, with similar treatment effectiveness. Active cluster systems would use ATU or PBTS that can support as many as 16 households. The collection network considerations for passive or active cluster systems are identical. Additional details about the scalability of each AWTS technology for use in a cluster system are included in the task 2 report.

For the larger disposal areas necessary for cluster systems, the U.S. Environmental Protection Agency (2002) recommends a groundwater mounding analysis to determine whether the hydraulic load to the drainfield infiltration surface or the load to the saturated zone under the infiltration surface will govern the design. As previously noted, a safety factor should be incorporated into the design. A common practice is to design multiple cells that provide 1.5 to 2 times the minimum required drainfield size to service the number of units. This approach allows the cells to be rotated in and out of service, providing a resting period between loadings. It also provides for some standby capacity that can be used in the event of malfunction of one of the cells. In addition to multiple cells, timed dosing and flow monitoring are recommended. With multiple cells, smaller distribution networks combined with smaller and more frequent dosing can be used, thereby maximizing oxygen transfer in the soil, and preventing the natural hydraulic capacity of the soil from being overwhelmed.

2.9 Technology Suitability for Retrofit Versus New Development

The aforementioned technologies can be used in both retrofit and new development applications, although some technologies are more suitable than others. Technologies that do not require land external to the parcel served—such as individual ATUs, PBTSs, and INRBs—are more suitable for retrofits. Central sewer can be used within retrofit areas, although it can be more difficult and costly to construct within areas that do not currently have an established right-of-way or utility easement. As discussed above, in more level terrain, the practicality of gravity sewer installation can be limited, and a more costly pressure system must be designed. Cluster systems have some of the same limitations as central sewer, with the addition of finding suitable land for the installation of the larger drainfield. In more dense areas or areas with smaller average parcel sizes, finding suitable land adjacent to the retrofitted parcels can be difficult and expensive. The opportunities to use these technologies for retrofit will be evaluated in specific areas of the county as part of task 5.

Where conventional OSTDSs exist, ATUs, PBTSs, and INRBs are constructed on the subject property within the spatial extent of the existing OSTDS, such that additional land is not necessary for construction. These technologies can be used in new developments when the cost to extend existing sewer laterals is greater than the cost for installing these technologies. In particular, ATUs and PBTSs can quickly outweigh the cost of extending an existing sewer lateral.

Where new development is proposed, the installation of the sewer collection system can easily be integrated into the proposed site development plan. Once the collection system is installed, the use of a cluster system or sewer main can be determined based on cost and location. For the purpose of cluster systems, the operating/maintenance authority needs to be established early on. In retrofit applications, this may be more difficult to set up and govern.

Table 3 shows the recommended technologies for retrofit applications and new development systems.

Table 3. Recommended technologies for retrofit and new development.

Retrofit Systems	New Development Systems
INRB	Centralized wastewater collection system
ATU	Cluster system
PBTS	
Cluster system	

2.10 Existing Wastewater Treatment Facility Available Capacity

Table 4 summarizes the available capacity of the existing WWTFs in Leon County. Average flow rates are based on the best available data from the monthly operating reports that each facility submits to DEP.

The City of Tallahassee's T.P. Smith Water Reclamation Facility accounts for approximately 92% of the total available capacity of the County. The additional capacity is divided by an average daily household flow rate of 300 gallons per day to determine number of potential households that could be converted to sewer. Currently, the average WWTF usage rate is 64.5% of the permitted capacity. This percentage increases during times of peak flows.

From the task 1 report, the number of existing OSTDSs in the County was estimated to be 25,885. If all these OSTDSs were converted to sewer, then the WWTF utilization rate will increase to 92.0%. The estimated number of OSTDSs in 2040 is 29,377, which will increase the WWTF utilization rate to 108%. Using the equivalent annual growth rate of 0.69% (task 1), the existing WWTF treatment capacity is estimated to be sufficient until 2028. WWTF expansion to serve all parcels within the unincorporated areas of Leon County has not been included in this analysis.

Table 4. WWTF capacity in Leon County.

Facility ID	WWTF Name	Design Capacity (MGD)	Average Flow Rate (MGD)	2020 Remaining Capacity (MGD)*	2040 Remaining Capacity (MGD)*	Additional 2040 Home Capacity**
FLA010139	T.P Smith Water Reclamation Facility	26.5000	17.28	9.2200	6.6630	22,210
FLA010148	Lake Bradford Estates MHP WWTF	0.0430	0.01	0.0330	0.0315	105
FLA010137	Disc Village Wastewater Treatment Plant (WWTP)	0.0200	0.00	0.0200	0.0200	67
FLA010136	Woodville Elementary School WWTP	0.0100	0.00	0.0100	0.0100	33
FLA010159	Meadows-at-Woodrun WWTF	0.0700	0.03	0.0400	0.0356	119
FLA010167	Sandstone Ranch WWTF	0.0707	0.05	0.0207	0.0133	44
FLA010152	Western Estates MHP WWTP	0.020	0.02	0.0000	0.0000	0
FLA010138	Fort Braden MHP WWTP	0.0110	0.01	0.0010	0.0000	0
FLA010151	Grand Village Mobile Home Park WWTP	0.0250	0.01	0.0150	0.0135	45
FLA010171	Lake Jackson WWTP	0.7500	0.26	0.4900	0.4515	1,505
FLA010173	Killearn Lakes WWTP	0.7000	0.53	0.1700	0.0916	305
Total		**28.2200**	**18.20**	**10.0200**	**7.3515**	**24,433**

*Remaining capacity is estimated using the average flow rate.

**Using an average home flow rate of 300 gallons per day.

2.11 Proximity to Centralized Wastewater Collection System

Transition from OSTDSs to a centralized wastewater collection system is more challenging where wastewater must be transported in the collection system a relatively long distance to a WWTF. Relatively longer extensions of the collection systems may require more land or easement, construction of additional wastewater pump stations, and use of additional construction materials than relatively shorter extensions. Longer extension may also result in more utility conflicts and a greater construction burden on the community, than shorter extensions. Therefore, transition of OSTDSs to ATUs, PBTSs, INRBs, or cluster systems may be more cost-effective on parcels that are relatively farther from a centralized wastewater collection system than parcels that are relatively closer to a centralized wastewater collection system.

Within task 5, this evaluation will be expanded to a location-specific analysis and provide more detailed information as it relates to individual areas within the county.

2.12 Anticipated Property Owner Participation Rate in Retrofit Activities

The anticipated property owner participation rate in retrofit activities is difficult to predict. It is likely that the countywide participation rate is a function of grants or subsidies to fund transition from OSTDSs to AWTSs or centralized wastewater collection systems. If transition is fully funded, property owner participation is likely greater than if transition is partly subsidized or not funded. A state grant and Leon County funding currently cover the costs associated with retrofits; however, these funding sources may not be available to fully fund retrofits in the future. If the regional economy is healthy, and wages satisfy fundamental needs, property owners may be more willing to partly fund transition. If transition is subsidized or not funded, the countywide or regional property owner participation rate is likely a function of cultural value systems and opinions associated with water quality. In parts of the county where property owners value water quality, the property owner participation rate may be greater than in parts of the county where property owners do not value water quality.

Based on recent Leon County projects, the property owner participation rate varies from 52% to 90% (Table 5). Several of these projects are not complete.

Table 5. *Owner participation rates in Leon County septic-to-sewer projects.*

Project	Participation Rate
Woodside Heights (complete)	90%
Annawood	66%
Belair	62%
Northeast Lake Munson	60%
Woodville	52%

2.13 Time Required for Implementation

Time required to implement each of treatment technology varies from days to years (Table 6).

Table 6. *Time in months to design, permit, and construct five alternative wastewater treatment systems.*

System	Design (months)	Permit (months)	Construction (months)	Property Acquisition (months)	Total (months)
Centralized wastewater collection system	6	6	12	24	48
Cluster system (existing development)	3	6	6	24	39
Cluster system (new development)	2	3	4	24	33
ATU	1	1	2	0	4
PBTS	1	1	2	0	4
INRB	0.75	0.75	0.5	0	2

Time to construct a centralized wastewater collection system depends on the complexity and size of the system. Centralized wastewater collection systems require modeling, engineering design, permit acquisition, and selection of a contractor for construction. Centralized wastewater collection systems typically involve complex public funding mechanisms with associated time demands to establish and distribute funds. Easement acquisition may take months, when required to extend the centralized wastewater collection system. Construction materials normally require 6 to 12 weeks to obtain. As long as two years may be needed to acquire the necessary property to construct the system. Therefore, a centralized wastewater collection system in Leon County will require up to four years to design, permit, acquire property, and construct.

Cluster systems that serve more than one dwelling also require engineering design and permitting. Cluster systems could be integrated into the design of new multi-dwelling developments. Land must be acquired to construct (or retrofit) cluster treatment systems that will service existing multi-dwelling developments. Cluster system construction materials are typically available in less than six weeks. Construction requires four to six months. As long as two years may be needed to acquire the necessary property to construct the system. Therefore, cluster systems in Leon County may require up to 33 months to construct a new system that will serve new multi-dwelling developments, and up to 39 months to construct (or retrofit) systems for existing multi-dwelling developments.

ATUs and PBTSs do not require additional land for construction and installation. ATUs and PBTSs are typically funded by the property owner or by a grant. ATU and PBTS designs are less complex than centralized wastewater collection systems. ATUs and PBTSs require additional septic tank components and new or re-built drainfields. Septic tank contractors can install ATUs and PBTSs. Most ATU and PBTS components do not require unique, individual manufacture and are typically purchased from an existing inventory available from national companies and local distributors. ATUs and PBTSs require six to eight weeks of engineering design and permitting. ATUs and PBTSs require about four months to design, permit, and construct.

INRB systems are much simpler to install than other AWTSs and only require the replacement of the drainfield. Four to six weeks of engineering and permitting is required for INRBs. In some instances, OSTDS tanks will be replaced if the tank is not structurally sound. INRBs are privately funded or funded with a grant. INRBs require two to three weeks of construction. INRBs require two months to design, permit, and construct.

For the purposes of this analysis, property acquisition has been included for the installation of cluster and central sewer systems. This may not be required for the installation of all such systems but can be a major time constraint when determining the practicality of these systems. In areas where existing easements, public right-of-way, and/or available land must be obtained, legal seizure of required land may be needed.

2.14 Local Comprehensive Plan Direction Regarding Wastewater Treatment

The Tallahassee-Leon County 2030 Comprehensive Plan includes several requirements related to use and siting of OSTDSs, and to the expansion of the centralized wastewater collection system, which must be considered when determining which treatment technologies to use in specific areas in the county.

Information on OSTDSs is found in several policies. Policy 1.2.1 [SS] states that the "minimum lot size for a septic tank shall be one-half acre." Policy 2.2.14 [C] states that "septic tanks…shall not be placed in the lake protection zone (100-year floodplain) unless there is no reasonable alternative. No part of a septic system may be located within 75 feet of the normal high-water line of a water body or jurisdictional wetland." Policy 2.3.2 [C] places limits on OSTDSs in the Lake Jackson Special Development Zone. In this area, no new OSTDSs can be installed on lots less than one acre, and no new septic systems can be placed in the 100-year floodplain. Policy 1.2.5 [SS] requires that "facilities other than traditional septic systems must be provided before development is allowed in areas where severe soil limitations exist for septic systems." Policy 1.2.6 [SS] requires the use of performance-based OSTDSs in the PSPZ where centralized wastewater collection systems are not available. Policy 4.2.5 [C] adds to Policy 1.2.6, requiring that a traditional OSTDS be upgraded to performance-based OSTDS when the OSTDS fails.

For centralized wastewater collection systems, Policy 2.2.14 [C] also applies, requiring that "… pump or lift stations, or sewer lines shall not be placed in the lake protection zone (100-year floodplain) unless there is no reasonable alternative." Policy 1.3.1 [SS] states that areas outside the urban service area—designated rural communities and urban fringe—"shall obtain sewage treatment through the use of an onsite system or a package plant." Policy 1.3.2 [SS] allows the extension of centralized wastewater collection systems to areas outside the urban service area but in the urban fringe to serve an existing residential subdivision "to correct an environmental or health problem associated with failing septic systems or to serve a new Conservation subdivision or permitting non-residential use that is in compliance with the Comprehensive Plan." This policy would apply since the Upper Wakulla River and Wakulla Spring BMAP identifies an environmental problem associated with the existing septic systems. Subdivisions meeting these criteria are shown in figure 6.

For cluster systems, Policy 1.3.1 [SS] states that "an onsite system may serve more than one parcel but only to correct an existing environmental problem." This policy would apply since the Upper Wakulla River and Wakulla Spring BMAP identifies an environmental problem associated with the existing septic systems. The capacity of these facilities shall be limited to that necessary to serve development existing on or prior to February 1, 1990."

In addition, the Upper Wakulla River and Wakulla Spring BMAP OSTDS Remediation Plan has requirements that must be considered. This plan prohibits new conventional OSTDSs on lots in the PFAs less than one acre, unless the OSTDS includes enhanced treatment for nitrogen or a connection to the centralized wastewater collection system will be available within five years. When an existing traditional OSTDS must be repaired or replaced, the OSTDS must include nitrogen reducing enhancements, unless connection to the centralized wastewater collection system will be available within five years.

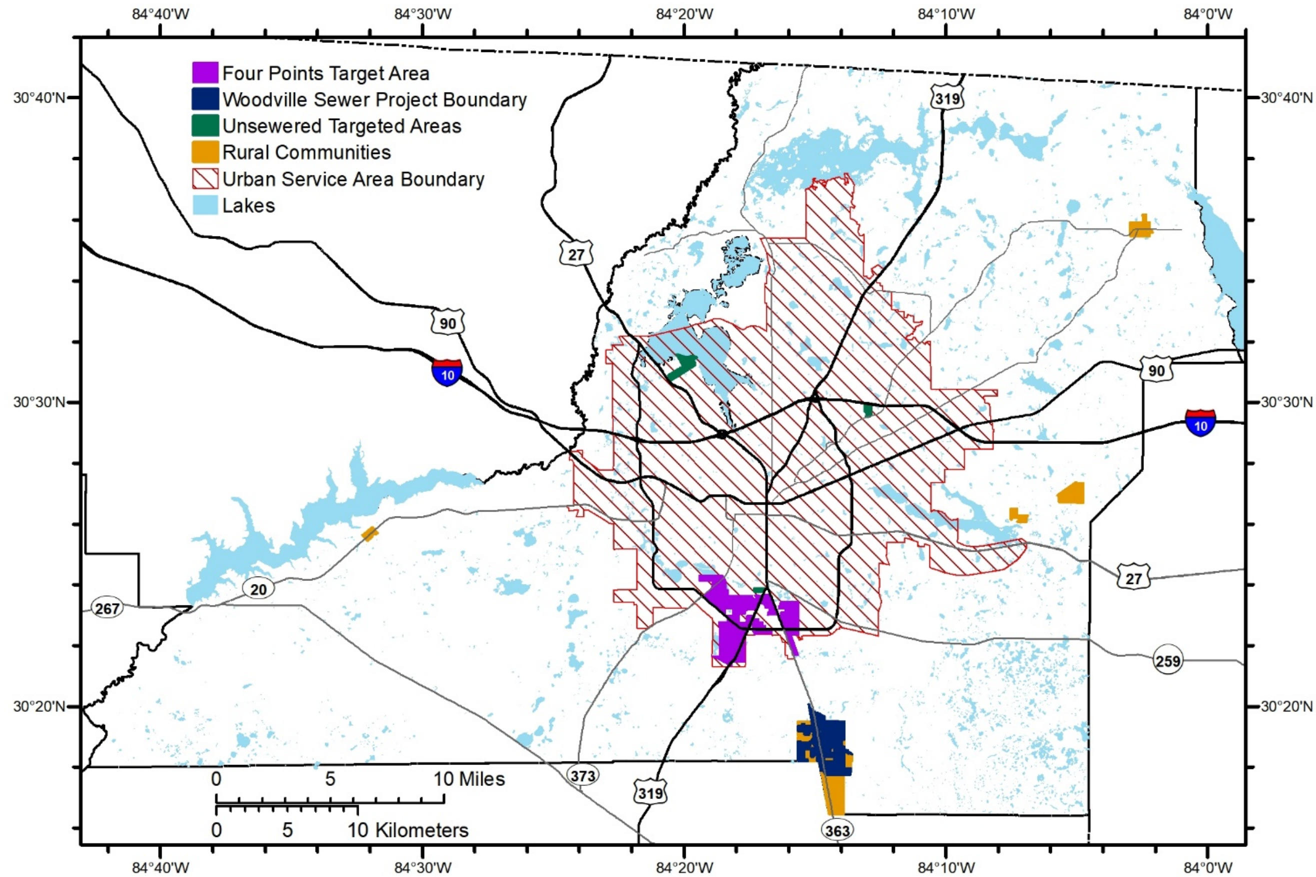

Figure 6. Urban service area, rural communities and unsewered target areas.

2.15 Current State Rules on Septic System Permit Requirements

Septic system permitting is currently administered by the Florida Department of Health. However, as part of the 2020 Clean Waterways Act (Senate Bill 712), the Onsite Sewage Program will be transferred to DEP by July 1, 2021.

For conventional OSTDSs, an application must be completed and submitted, along with a site plan, to the local county health department for approval. OSTDSs must meet requirements of Chapter 64E-6, Florida Administrative Code.

ATUs and PBTSs are required to have a biennial operating permit, have a maintenance contract with an approved maintenance entity, and allow inspection by the local health department in accordance with Chapter 64E-6, Florida Administrative Code. In addition, PBTSs must be engineer-designed for permit approval. ATUs must be certified by National Sanitation Foundation International as capable of providing at least 50% nitrogen reduction before treated wastewater is discharged to the drainfield. If there is less than a 24-inch separation between the drainfield and seasonal high-water table, the ATU must be capable of reducing nitrogen by at least 65% before discharge to the drainfield. For a PBTS installed with at least a 24-inch separation between the bottom of the drainfield and the seasonal high-water table, it must be capable of reducing nitrogen by at least 50% before discharge to the drainfield, for at least 65% overall treatment, including the drainfield. If there is less than a 24-inch separation, the PBTS must be capable of reducing nitrogen by at least 65% before discharge to the drainfield.

For INRBs, the provisions of Rule 64E-6.009(7), Florida Administrative Code, apply. This rule requires that the drainfield be installed over sand fill that is at least 18 inches thick and extends at least one foot beyond the perimeter of the drainfield. Below this sand layer, the media layer must be at least 12 inches thick and extend at least 24 inches beyond the perimeter of the drainfield. The media layer must also extend upward along the boundary of the sand fill material to about four to six inches below the bottom of the drainfield. The media layer cannot be installed when the observed water table is at or above the lowest depth of the media layer, and the bottom of the media layer must be at least 6 inches above the wet season water table. No media can be within 18 inches of the infiltrative surface of the drainfield. Upon completion of media layer installation, the local health department must inspect it before the media is covered. There is a fee for this inspection. Final approval must be provided by the local health department after all records have been completed and filed. These systems are not required to have an operating permit or a maintenance contract.

3.0 Treatment System Evaluation

In task 1, the JSA team calculated a nitrogen reduction score using the geologic criteria. As part of this task 3 report, the JSA team added another element to the nitrogen reduction score by including mitigation criteria. The mitigation criteria are the evaluation factors described in Section 2.0, and Table 8 provides a matrix to evaluate each of the mitigation factors for technology implementation. The scoring shown in this matrix was developed as a countywide evaluation for this task. The matrix will be applied to specific areas in the county, along with the geologic criteria, to determine appropriate technologies in task 5.

The evaluation factors with the greatest importance to this study were assigned a weight of 3 and factors with a lesser priority were assigned a weight of 1. An explanation of the weight assigned to each evaluation factor is included in Table 7.

Table 7. *Rationale for Weight of Each Evaluation Factor*

Evaluation Factor	Weight	Rationale for Weight
Site Proximity to PFA and PSPZ	3	The PFA and PSPZ are the most vulnerable areas to nitrogen loading from OSTDS.
Right-of-Way Acquisition	3	Acquisition can be time consuming and costly, affecting schedules and budgets to address the nutrient loading from OSTDS.
Technology Performance History	3	The performance history is a key factor in determining the expected nutrient reductions from each technology.
Suitability of Retrofit	3	The BMAP focuses on addressing nutrient loads from existing OSTDS so the ability to retrofit is important.
Time Required for Implementation	3	The BMAP includes a timeline for achieving nutrient reductions so options that can be implemented in a timely manner are important.
Local Comprehensive Plan Direction for Wastewater	3	The Comprehensive Plan details what technologies can be used in different locations and implementation requirements that must be considered.
Site Proximity to Urban Service Area	2	The proximity is important for determining which areas can be connected to the central sewer system.
Density of Existing Development and Future Land Use	2	The existing and planned densities will play a role in determining which technologies will work best to provide for treatment.
Impact to Existing and Future Land Use	2	The existing and future land uses will play a role in determining which technologies will work best to provide for treatment.
Suitability to New Development	2	It will be important to address future nutrient loading through implementation of AWTS.
Existing WWTF Available Capacity	2	Parcels can only be connected to the central sewer system if the WWTFs have available capacity.

Evaluation Factor	Weight	Rationale for Weight
Anticipated Property Owner Participation Rate	2	Nutrient reductions will occur only if property owners upgrade their traditional OSTDS.
State Rules on Septic System Permit Requirements	2	The state rules detail the requirements for AWTS implementation that must be considered.
Proximity to Centralized Wastewater Collection System	1	This factor is a consideration only in the ability to most cost effectively connect parcels to the central sewer system.
Scalability of Technology	1	Options for AWTS can be implemented at different scales depending on conditions in each area of the county.
Adjacent Land Availability	1	Land availability is a consideration mostly for cluster systems but may also be needed for central sewer easements.

Technologies were given a score of 1 or 2 for each evaluation factor. A score of 1 represented a con, such as the need for adjacent land availability for a cluster system. A score of 2 represented a pro, such as the known history of technology performance for sewer, ATUs, and PBTSs. No score was assigned when a factor was not applicable or considered neutral to the technology, such as the existing WWTF available capacity for ATUs, PBTSs, and INRBs.

The score were multiplied by the weight for each factor and then divided by the total weight to determine a weighted mean score for each technology. The total weight was calculated for each technology to remove factors that were not applicable to that technology. For this countywide evaluation, INRBs received the highest score, which means INRBs may generally be the most feasible technology for treatment throughout the county, where conditions are suitable. PBTSs, ATUs, sewer, and cluster systems followed in the scoring (see Table 8). While cluster systems scored lowest in this countywide evaluation, this technology may be the most appropriate in specific areas of the county and for new development, which will be further studied in task 5.

Table 8. *Matrix of pros and cons with weights for technology implementation*

Evaluation Factor	Weight	Sewer	ATU	PBTS	INRB	Cluster
Site Proximity to PFA and PSPZ	3	2	2	2	2	
Site Proximity to Urban Service Area	2	2				1
Adjacent Land Availability	1					1
Right-of-Way Acquisition	3	1	2	2	2	1
Density of Existing Development and Future Land Use	2	2				2
Impact to Existing and Future Land Use	2	1	1	1	2	
Technology Performance History	3	2	2	2		1
Scalability of Technology	1	2	1	1	1	2
Suitability of Retrofit	3	1	2	2	2	1
Suitability to New Development	2	2	2	2	2	2
Existing WWTF Available Capacity	2	1				
Proximity to Centralized Wastewater Collection System	1	2				
Anticipated Property Owner Participation Rate	2	1	2	2	2	
Time Required for Implementation	3	1		2	2	1
Local Comprehensive Plan Direction for Wastewater	3	2				1
State Rules on Septic System Permit Requirements	2		1	1	2	1
Score	-	*1.53*	*1.76*	*1.79*	*1.95*	*1.20*

2	Pro/Beneficial (2 points)
	Not Applicable or Neutral

1	Con/Not Beneficial (1 points)

The JSA team made the following assumptions in this evaluation:

- The evaluation of treatment technologies was conducted on a countywide basis. An evaluation using all factors from tasks 1, 2, and 3 will be conducted for specific areas of the county in task 5.
- Items that were deemed not applicable are based on the likelihood that a factor and technology are not directly comparable in a pro/con scoring matrix. Some factors that were deemed not applicable may be used when making technology selections in task 5.

4.0 Preliminary Findings

The JSA team determined the following:

Finding 1. On a countywide basis, INRBs scored the highest, followed by PBTSs and ATUs, using the evaluation factors for mitigation criteria in task 3.

Finding 2. On a countywide basis, cluster systems scored the lowest using the evaluation factors for mitigation criteria in task 3. However, cluster systems may be the best option for specific areas of the county, which will be evaluated further in upcoming tasks.

Finding 3. The applicability of each of the evaluation factors is specific to the conditions in each part of the county.

The JSA team may refine these findings as the present task 3 draft report is finalized and as plan development progresses.

5.0 References

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